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Sub-Committee of Experts on the Transport of Dangerous Goods

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Item 10 (e) of the provisional agenda
Issues relating to the Globally Harmonized System of Classification and Labelling of Chemicals: Joint work with the GHS Sub-Committee

Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals

Thirty-fifth session
Geneva, 4-6 July 2018
Item 2 of the provisional agenda
Joint work with the Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-Committee)

Proposal to classify chemicals under pressure within Chapter 2.3 of the GHS

Submitted by the European Chemical Industry Council (CEFIC) and the European Industrial Gases Association (EIGA)*

Introduction

1. Some years ago the Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-Committee) adopted new UN numbers for chemicals under pressure (UN Nos. 3500 to 3505). These products function similarly to aerosol dispensers (UN No. 1950), but are packed in pressure receptacles (refillable and non-refillable) up to 450 litres. These UN numbers are also used by EIGA members to transport liquids that are packed under a head of pressure for inerting the product or to facilitate its transfer in process lines (e.g., benzene under hydrogen pressure). With the implementation of GHS in more and more countries, the question came up how these products need to be classified and labelled according to the GHS.

* In accordance with the programme of work of the Sub-Committee for 2017–2018 approved by the Committee at its eighth session (see ST/SG/AC.10/C.3/100, paragraph 98 and ST/SG/AC.10/44, para. 14).

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Chemicals under pressure in Chapter 2.3 of the GHS

2. Chemicals under pressure used for spray applications present hazards that are similar to aerosol dispensers. Due to the similarities in hazards, aerosols and chemicals under pressure can be combined in the same chapter (2.3) of the GHS using similar classification criteria for the hazard of flammability. Covering these similar hazards in one chapter should also ensure consistency in the future, i.e. that modifications are introduced consistently to both, aerosols and chemicals under pressure, whenever appropriate. This approach was presented in the draft proposal outlined in informal document INF.12 considered by the GHS Sub-Committee, and supported with comments, at its thirty-third session. This approach was developed with the relevant consequential amendments in informal document INF.15, considered by the GHS Sub-Committee at its thirty-fourth session.

3. As pointed out above, the hazards of aerosols and chemicals under pressure are comparable. Nevertheless, there are some specific aspects with regard to classification. The most obvious is that there are specific test methods for aerosols allowing for the assignment of the category based on further criteria in addition to the content of flammable components and the heat of combustion (such test methods do not exist for chemicals under pressure). Due to these specifics, aerosols and chemicals under pressure are covered in two different sections within chapter 2.3, thus avoiding a rather complicated list of criteria and a cumbersome flow-chart.

4. The attached proposal renames chapter 2.3 as "Aerosols and Chemicals Under Pressure" and clearly distinguishes the requirements for aerosols and for chemicals under pressure in separate sections. In this new structure, the present text from chapter 2.3 (Aerosols) is edited and renumbered as section 2.3.1, and the new text for chemicals under pressure is added after it in section 2.3.2. There is a common introduction added at the very beginning in 2.3.0 as well as common guidance in 2.3.3.

Note 1: Despite some comments provided at the thirty-fourth session, CEFIC and EIGA wish to keep the designation "Chemicals under pressure"» to stay aligned with the designation used for transport. "Chemicals under pressure" describes adequately a potential mixture of solids, liquids and gaseous components at a sufficient pressure and distinguishes e.g. liquids under an inert atmosphere.

Classification of chemicals under pressure

5. The attached proposal for chemicals under pressure follows the same classification strategy as for aerosols:

- for the flammability hazard: 3 categories are proposed (Cat.1: Extremely flammable chemicals under pressure, Cat.2: Flammable chemicals under pressure, and Cat.3: Chemical under pressure.
- for other hazards: the same sentence as the existing one for aerosols is inserted in the new section 2.3.2 for chemicals under pressure *"Depending on their contents, chemicals under pressure may however fall within the scope of other hazard classes, including their labelling elements"*. For both aerosols and chemicals under pressure, it should be kept in mind that these hazards cover only physical hazards and that health and environmental hazards have to be considered independently.

6. New labelling requirements are also proposed for chemicals under pressure, including new hazard statements. Two pictograms are proposed for categories 1 and 2 and one for category 3. This is in line with the way gases under pressure are addressed in the GHS. Regarding the hazard statements for chemicals under pressure, the two statements used for categories 1 and 2 have been merged into one hazard statement, and "may explode if heated" has been added at the end of the hazard statement for all three categories.

"Chemicals under pressure" versus "Gases under pressure" versus "Liquids"

7. Mixtures of liquids (and solids) with gases may be packaged at different concentrations and at different pressures. When released to the atmosphere during their normal use or accidentally the mixtures will present different flammability hazards depending on the concentration of liquids or gases and the pressure in the container. In order to differentiate "chemicals under pressure" from "gas mixtures" that may also contain liquid components, and to differentiate "liquids" under a low gas pressure head for inerting, from "chemicals under pressure", it is necessary to introduce some cut-off values.

(a) The components of "chemicals under pressure" are "predominantly liquids or solids", while the components of gas mixtures are "predominantly gaseous". The value of 50% of liquids or solids is proposed as a cut-off value to differentiate chemicals under pressure from gas mixtures.

Note: Below 50%, the flammability hazard would be tested or calculated according to the criteria for "flammable gases" determined in ISO10156.

(b) 200 kPa (gauge) is the minimum pressure used in chapter *2.5 (Gases under pressure)* and is proposed as the cut-off value to differentiate chemicals under pressure from liquids packed under a low pressure head of gas.

Example: The example below shows the different flammability classifications of a mixture of a flammable liquid (n-pentane) with a flammable liquefied gas (propane) at different concentrations and pressures as raised at the last SC meeting

Composition	**49** % w/w n-Pentane in propane; p>200 kPa	**50**% w/w n-Pentane in propane; p>200 kPa	**80**% w/w n-Pentane in propane p< 200kPa
Classification (flammability)	Flammable gas Cat 1A	Chemical under pressure Cat 1	Flammable liquid Cat 1 *(Note)*
Pictogram	Flame + Gas cylinder	Flame + Gas cylinder	Flame
Signal word	Danger	Danger	Danger
Hazard statement	Extremely flammable gas. Contains gas under pressure: may explode if heated	Extremely flammable chemical under pressure. May explode if heated	Extremely flammable liquid and vapour

Note: *n-Pentane is a flammable liquid Cat 2 according to the harmonised classification in Annex VI of the Regulation (EC) No 1272/2008 of the European Parliament and of the Council (CLP Regulation). EIGA recommends classifying flammable liquid mixtures with a flammable gas as Cat 1 when the concentration of the flammable gas is higher than 5%.*

8. The consequential amendments in the other parts of the GHS are set out after the proposed text for the revised Chapter 2.3.

Action

9. The Sub-Committee is invited to agree the proposed new text in Chapter 2.3 of the GHS and the consequential amendments set out below. Amendments to the existing text on aerosols will be the subject of a separate proposal.

Proposal

10. Replace current chapter 2.3 with the following:

"Chapter 2.3

Aerosols and chemicals under pressure

2.3.0 Introduction *(New text)*

This chapter contains the definitions, classification criteria, hazard communication elements, decision logics and guidance for aerosols and chemicals under pressure. Although they present similar hazards, aerosols and chemicals under pressure are separate hazard classes and are covered in separate sections. While the hazards are similar and the classification is based on flammable properties and heat of combustion, they are presented in two different sections due to allowable pressure, capacity and construction of the two kinds of receptacles. A substance or mixture is classified as either an aerosol in accordance with 2.3.1 or a chemical under pressure in accordance with 2.3.2.

[**2.3.1 Aerosols** *(The amendments to the existing text will be the subject of a separate proposal)*]

2.3.2 Chemicals under pressure *(New text)*

2.3.2.1 *Definition*

Chemicals under pressure are mixtures containing 50% or more by mass of liquids or solids (e.g., pastes or powders) and one or more gases, in pressure receptacles other than aerosol dispensers, at a pressure of 200 kPa (gauge) or more at 20 °C. The gas can be a compressed, liquefied or dissolved gas under pressure.

NOTE: *Mixtures, containing less than 50% by mass of liquids or solids, (e.g., pastes or powders), should be considered for classification as gases under pressure (see chapter 2.5) or, if not meeting the criteria for classification as gases under pressure, should be considered for other physical hazard classes appropriate for liquids or solids (see decision logic 2.3.2).*

2.3.2.2 *Classification criteria*

2.3.2.2.1 Chemicals under pressure are classified in one of three categories, depending on their flammable properties and their heat of combustion (see 2.3.2.4.1).

2.3.2.2.2 Chemicals under pressure should be classified in Category 1 if:

(a) they contain at least 85% components (by mass) which are classified as flammable according to the GHS criteria, i.e.:

- Flammable gases (see Chapter 2.2);
- Flammable liquids (see Chapter 2.6);
- Flammable solids (see Chapter 2.7);

(b) and their heat of combustion is at least 20 kJ/g.

2.3.2.2.3 Chemicals under pressure are classified in Category 3 if:

(a) they contain 1% or less components (by mass) that are classified as flammable according to the above GHS criteria, and;

(b) the heat of combustion is less than 20 kJ/g.

2.3.2.2.4 Chemicals under pressure are classified in Category 2 if they do not meet the criteria for Category 1 or 3.

NOTE 1: *The flammable components in a chemical under pressure do not include pyrophoric, self-heating or water-reactive substances and mixtures because such components are not allowed in chemicals under pressure according to the Recommendations on the Transport of Dangerous Goods, Model Regulations.*

NOTE 2: *Chemicals under pressure do not fall additionally within the scope of section 2.3.1 (aerosols), chapters 2.2 (flammable gases), 2.5 (gases under pressure), 2.6 (flammable liquids) and 2.7 (flammable solids). Depending on their contents, chemicals under pressure may however fall within the scope of other hazard classes, including their labelling elements.*

2.3.2.3 *Hazard communication*

General and specific considerations concerning labelling requirements are provided in *Hazard communication: Labelling* (Chapter 1.4). Annex 1 contains summary tables about classification and labelling. Annex 3 contains examples of precautionary statements and pictograms which can be used where allowed by the competent authority.

Table 2.3.2.1: Label elements for chemicals under pressure

	Category 1	Category 2	Category 3
Symbol	Flame Gas cylinder	Flame Gas cylinder	Gas cylinder
Signal word	Danger	Warning	Warning
Hazard statement	Extremely flammable chemical under pressure: May explode if heated	Flammable chemical under pressure: May explode if heated	Chemical under pressure: May explode if heated

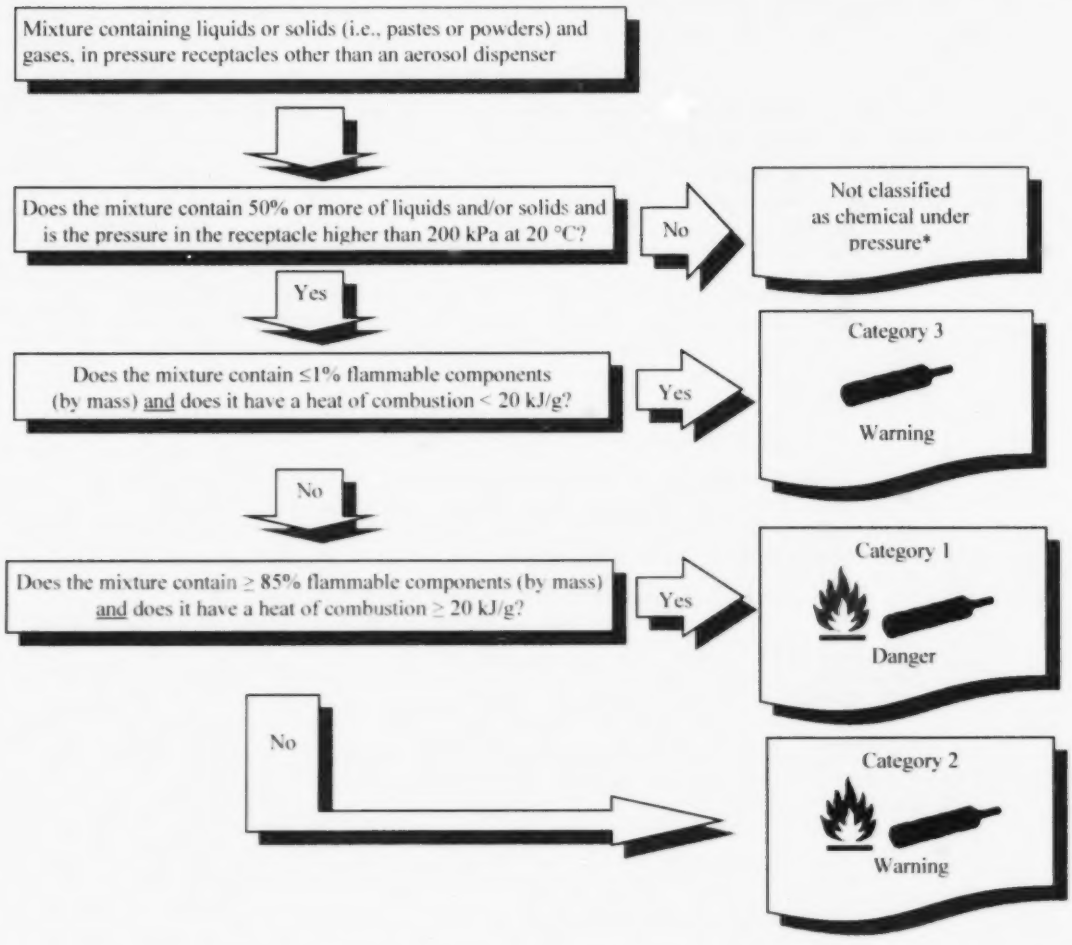
2.3.2.4 *Decision logic and guidance*

The decision logic 2.3.2 and the guidance on chemical heat of combustion in 2.3.3 which follow are not part of the harmonised classification system but have been provided as additional guidance. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

2.3.2.4.1 *Decision logic*

To classify a mixture as chemicals under pressure, data on its pressure, its flammable components, and on its specific heat of combustion are required. Classification should be made according to decision logic 2.3.2.

Decision logic 2.3.2


Mixture containing liquids or solids (i.e., pastes or powders) and gases, in pressure receptacles other than an aerosol dispenser
Does the mixture contain 50% or more of liquids and/or solids and is the pressure in the receptacle higher than 200 kPa at 20 °C?
No
Not classified as chemical under pressure*
Yes
Does the mixture contain ≤1% flammable components (by mass) and does it have a heat of combustion < 20 kJ/g?
Yes
Category 3
Warning
No
Does the mixture contain ≥ 85% flammable components (by mass) and does it have a heat of combustion ≥ 20 kJ/g?
Yes
Category 1
Danger
No
Category 2
Warning

*should be considered for classification in other physical hazard classes as appropriate

2.3.3 Guidance on specific heat of combustion

The specific heat of combustion (Δhc), in kilojoules per gram (kJ/g) is the product of the theoretical heat of combustion (Δh_{comb}) and the combustion efficiency, usually less than 1.0 (a typical efficiency is 0.95 or 95%).

For a composite formulation, the specific heat of combustion is the summation of the weighted heats of combustion for the individual components, as follows:

$$\Delta hc\ (product) = \sum_{i}^{n} [w_i\% \times \Delta hc_i]$$

Where:

Δhc = specific heat of combustion (kJ/g);

$w_i\%$ = mass fraction of component i in the product;

Δhc_i = specific heat of combustion (kJ/g) of component i in the product;

The specific heat of combustion can be found in the scientific literature, calculated or determined by tests (see ASTM D 240, NFPA 30B.)".

Consequential amendments

Chapter 2.5 "Gases under Pressure"

Amend the note under 2.5.2.1 to read as follows *(new text is underlined)*:

"***NOTE***: *Aerosols and chemicals under pressure should not be classified as gases under pressure. See Chapter 2.3.*

Annex 1

Amend table A1.3 as follows *(new text is underlined)*:

"**A1.3** **Aerosols and Chemicals under pressure** *(see Chapter 2.3 for classification criteria)*

Classification		Labelling				Hazard statement codes
Hazard class	Hazard category	Pictogram		Signal word	Hazard statement	
		GHS	UN Model Regulations[a]			
Aerosols (section 2.3.1)	1			**Danger**	Extremely flammable aerosol Pressurized container: may burst if heated	H222 H229
	2			**Warning**	Flammable aerosol Pressurized container: may burst if heated	H223 H229
	3	*No pictogram*		**Warning**	Pressurized container: may burst if heated	H229
Chemicals under pressure (section 2.3.2)	1			**Danger**	Extremely flammable chemical under pressure: may explode if heated	H282
	2			**Warning**	Flammable chemical under pressure: may explode if heated	H283
	3			**Warning**	Chemical under pressure: may explode if heated	H284

[a] *Under the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, the symbol, number and border line may be shown in black or white. The background colour is red for categories 1 and 2 and green for category 3.*".

Annex 3, Section 1, Table A3.1.1

Insert the following rows:

Code (1)	Physical hazard statements (2)	Hazard class (GHS chapter) (3)	Hazard category (4)
H282	**Extremely flammable chemical under pressure: May explode if heated**	Chemicals under pressure (chapter 2.3)	1
H283	**Flammable chemical under pressure: May explode if heated**	Chemicals under pressure (chapter 2.3)	2
H284	**Chemical under pressure: May explode if heated**	Chemicals under pressure (chapter 2.3)	3

Annex 3, Section 2, Table A3.2.2

Insert the following rows:

Code (1)	Prevention precautionary statement (2)	Hazard class (3)	Hazard category (4)	Conditions for use (5)
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking	Chemicals under pressure (chapter 2.3)	1, 2, 3	
P211	Do not spray on an open flame or other ignition source	Chemicals under pressure (chapter 2.3)	1, 2	

Annex 3, Section 2, Table A3.2.3

Insert the following rows:

Code (1)	Response precautionary statement (2)	Hazard class (3)	Hazard category (4)	Conditions for use (5)
P381	In case of leakage, eliminate all ignition sources	Chemicals under pressure (chapter 2.3)	1.2	
P376	Stop leak if safe to do so	Chemicals under pressure (chapter 2.3)	1, 2, 3	
P370 + P378	In case of fire, use ... to extinguish	Chemicals under pressure (chapter 2.3)	1, 2	Manufacturer/supplier or the competent authority to specify appropriate media

Annex 3, Section 2, Table A3.2.4

Insert the following rows:

Code (1)	Storage precautionary statement (2)	Hazard class (3)	Hazard Category (4)	Conditions for use (5)
P403	Store in a well-ventilated place	Chemicals under pressure (chapter 2.3)	1, 2, 3	
P410	Protect from sunlight	Chemicals under pressure (chapter 2.3)	1, 2, 3	*May be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow) decomposition or polymerization, or the competent authority provides otherwise.*
P410 + P403	Protect from sunlight. Store in a well-ventilated place	Chemicals under pressure (chapter 2.3)	1, 2, 3	*P410 may be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow) decomposition or polymerization, or the competent authority provides otherwise.*

Annex 3, Section 3, Matrix of precautionary statements by hazard class/category

Insert the following tables:

"Chemicals under pressure (Chapter 2.3 section 2.3.2)

Hazard category	Symbol	Signal word	Hazard statement
1	Flame and gas cylinder	Danger	H282 Extremely flammable chemical under pressure: May explode if heated
2	Flame and gas cylinder	Warning	H283 Flammable chemical under pressure: May explode if heated

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
P210 Keep away from heat, hot surfaces, sparks open flames and other ignition sources. No smoking P211 Do not spray on an open flame or other ignition source	P381 In case of leakage, eliminate all ignition sources P376 Stop leak if safe to do so P370 + P378 In case of fire, use ... to extinguish	P410 + P403 Protect from sunlight. Store in a well-ventilated place *P410 may be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow)decomposition or polymerisation, or the competent authority provides otherwise.*	

Hazard category	Symbol	Signal word	Hazard statement
3	Gas cylinder	Warning	H284 Chemical under pressure: May explode if heated

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
P210 Keep away from heat, hot surfaces, sparks open flames and other ignition sources. No smoking	P376 Stop leak if safe to do so	P410 + P403 Protect from sunlight. Store in a well-ventilated place *P410 may be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow) decomposition or polymerization, or the competent authority provides otherwise*	

"

Annex 4, section 9, Table A4.3.9.2 (Data relevant with regard to physical hazard classes (supplemental)

Add a new row for chemicals under pressure as follows:

Chapter	Hazard Class	Property/Safety characteristic/ Test result and Remarks/Guidance
2.3, section 2.3.2	Chemicals under pressure	– indicate the total percentage (by mass) of flammable components – indicate the specific heat of combustion (generally in kJ/g)